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Reg. No. : .....

Name : .....

Seventh Semester B.Tech. Degree Examination, October 2014
(2008 Scheme)
08.702 : DESIGN AND ANALYSIS OF ALGORITHMS (R)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **(10×4=40 Marks)**

1. Define Big-oh, Big-omega and Theta notations.
2. Identify the loop-invariant in the algorithm for insertion sort.
3. Master-method does not apply to the recurrence, $T(n) = 2T(n/2) + n \lg n$. Justify the statement.
4. Give a recurrence for merge sort algorithm and solve it.
5. Prove that Kruskal's algorithm generates a minimum weight spanning tree for every connected undirected graph G.
6. What are the various operations on disjoint sets ?
7. What do you mean by strongly connected components ? How can you find the strongly connected components of a graph by using disjoint set operations ?
8. The way we parenthesize a chain of matrices can have a dynamic impact on the cost of evaluating the product. Justify the statement with an example.
9. Explain the backtracking method.
10. What is branch and bound strategy ?

P.T.O

PART – B

Answer **one full** question from **each** module. **(20×3=60 Marks)**

MODULE – I

11. a) Write the Pseudo code for Max-heapify (A, i), which maintains the heap property. Illustrate with figures the operation of Max-heapify (A, 3) on the array.

$A = \langle 27, 17, 3, 16, 13, 10, 1, 5, 7, 12, 4, 8, 9, 0 \rangle$ **8**

b) What is the effect of calling Max-heapify (A, i)

i) When the element A[i] is greater than its children ?

ii) When i is greater than $(\text{heap size } [A])/2$? **4**

c) In building a heap, why is the Max-heapify procedure called for node at len. $[A]/2$ to 1, rather than from 1 to length $[A]/2$. **3**

d) Create a min-heap for the following list :

L = {20, 10, 1, 5, 40, 80, 60, 30}

Extract minimum element from the heap and show the resultant heap. Illustrate the various steps with figures. **5**

OR

12. a) Write an algorithm for insertion sort. Derive its worst-case and best-case running time. **10**

b) Prove that for any two functions f(n) and g(n), $f(n) = \theta(g(n))$ iff $f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$. **5**

c) Using a recursion-tree get an asymptotically tight solution to the recurrence : $T(n) = T(n-a) + T(a) + cn$; $a \geq 1$, $c>0$ are constants. **5**

MODULE – II

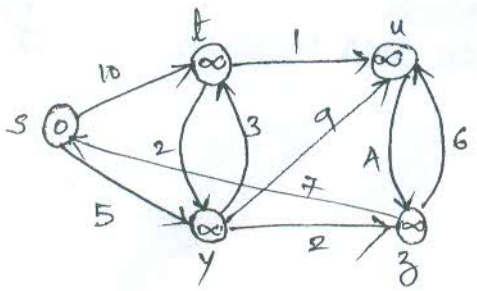
13. a) What are the different cases in insertion of a node into a RB tree ? **10**

b) Write an algorithm for building a minimum-spanning tree by Prim's method. Explain the loop invariant. **10**

OR

14. a) Prove the correctness of Dijkstra's algorithm. 7

b) Execute Dijkstra's algorithm on graph below, with 's' as the source vertex.



5

c) Explain the double rotation operation on AVL trees with an example. 8

MODULE – III

15. a) Give an algorithm for Knapsack problem by greedy strategy. 5

b) Find an optimal solution to the Knapsack instance n = 3, M = 20 by greedy method : $(p_1, p_2, p_3) = (60, 100, 120)$ and $(w_1, w_2, w_3) = (10, 20, 30)$. Can 0 – 1 Knapsack problem be solved by greedy method ? Justify. 7

c) Write short notes on NP-completeness and NP-hardness. 8

OR

16. a) Consider the TSP instance defined by the cost matrix.

$$\begin{bmatrix} \alpha & 7 & 3 & 12 & 8 \\ 3 & \infty & 6 & 14 & 9 \\ 5 & 8 & \infty & 6 & 18 \\ 9 & 3 & 5 & \infty & 11 \\ 18 & 14 & 9 & 8 & \infty \end{bmatrix}$$

Obtain the reduced cost matrix. Also derive the state space tree generated by branch and bound method. 15

b) Illustrate the operation of merge sort on the array.
$A = \langle 3, 41, 52, 26, 38, 57, 9, 49 \rangle$. 5